

# Analysis of the Long-Term Effect of the MBST® Nuclear Magnetic Resonance Therapy on Gonarthrosis

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## Introduction

Osteoarthritis is the most frequently occurring joint disease worldwide. According to estimations of the Robert Koch Institute and the Statistisches Bundesamt [German Federal Statistics Office], approximately every 10th to 20th citizen aged between 50 and 60 suffer from arthritic changes to the joint cartilage and the associated typical arthrosis-related pain, whereby the osteoarthritis incidence increases annually by 1 to 2% from the 40th year (1). With osteoarthritis the physiological balance between cartilage degradation and cartilage build-up is significantly impaired which leads to degeneration of the cartilage tissue and later on also to degeneration of other joint structures. Chronic pain and worsening of the joint function with increasing joint stiffness accompany the everyday life of osteoarthritis patients and heavily restrict their activities. As the precise cause of osteoarthritis is often not known, the focus of treatment of conservative osteoarthritis therapy concerns the symptomatic, partly short-term alleviation of ailments so that in many cases the effect

## Summary

Keywords: Gonarthrosis - MBST® - osteoarthritis therapy

Based on a questionnaire for patient-queries regarding pain-sensation and activity restrictions during everyday tasks, the long-term effect of MBST® nuclear magnetic resonance therapy is studied in osteoarthritis of the knee. 39 patients, whose therapy dates back up to four years, participated in the study. In addition to an overall view, the success of this therapy is also analyzed regarding age, gender and physical activities. Overall, the study pointed out a sustained improvement in the patients' local health-status with

a significant pain-relief even after four years, but also with a slight increase in pain towards the end of that four-year period. There tends to be a more positive effect on women, on elderly or also on even non-sports-active patients which suggests a possible influence by daily (over)-stressing on the success of the therapy. An additional positive effect of the therapy on bone density is also conceivable, however this remains open.

for patients is often unsatisfactory. Additionally, taking medication, in particular when used in the long term can cause unwanted, partly serious side effects.

If strong pain symptoms occur during the advanced stage of osteoarthritis due to significant changes to joints, the implementation of operative procedures is often inevitable.



Keywords: gonarthrosis – MBST – arthrosis therapy

Auf der Basis von Patientenabfragen mittels Fragebogen zum Schmerzempfinden und zur Einschränkung bei Aktivitäten des alltäglichen Lebens wird die Langzeitwirkung der MBST® KernspinResonanzTherapie bei Gonarthrose untersucht.

An der Studie nahmen 39 Patienten teil, bei denen die Therapie bis zu vier Jahre zurückliegt. Neben einer Gesamtbeurteilung wird der Erfolg auch in Abhängigkeit von Alter, Geschlecht und sportlicher Aktivität analysiert.

Insgesamt weist die Studie auf eine anhaltende Verbesserung

mit zum Teil deutlicher Schmerzlinderung auch noch nach vier Jahren hin, jedoch mit einer leichten Schmerzzunahme gegen Ende des Untersuchungszeitraums von vier Jahren. Eine tendenziell positivere Wirkung bei Frauen, älteren Menschen oder auch sportlich nicht-aktiven Patienten lässt auf eine mögliche Beeinflussung des Erfolgs der Therapie durch (Über-)Belastungen im Alltag schließen. Ein zusätzlich positiver Effekt der Therapie auf die Knochendichte ist ebenfalls denkbar, dies bleibt jedoch offen.

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Based on a questionnaire for patient-queries regarding pain-sensation and activity restrictions during everyday tasks, the long-term effect of MBST® nuclear magnetic resonance therapy is studied in osteoarthritis of the knee. 39 patients, whose therapy dates back up to four years, participated in the study. In addition to an overall view, the success of this therapy is also regarding age, gender and physical activities. Alongside joint replacement there are alternative, newer arthroscopic approaches to treatment which however are only effective in the case of isolated cartilage defects and in the case of younger patients. In the event of a joint replacement operation it should be taken into

consideration that nowadays the durability of an endoprosthesis is determined to be approximately fifteen years and that it should only be replaced once. This problem and the increasing life expectancy illustrates the necessity of new innovative approaches to therapy in terms of osteoarthritis treatment.

Overall, the study pointed out a sustained improvement in the patients' local health-status with a significant pain-relief even after four years, but also with a slight increase in pain towards the end of that four-year period. There tends to be a more positive effect on women, on elderly or also on even non-sports-active patients which suggests a possible influence by daily (over)-stressing on the success of the therapy. An additional positive effect of the therapy on bone density is also conceivable, however this remains open.

During the past few years the nuclear magnetic resonance therapy (MBST®) developed by MedTec Medizintechnik GmbH is increasingly used as an alternative contact-free form of therapy. In a range of in vitro studies (2-4) and tests on an animal model (5, 6) in the same laboratory, a simulation of the ability to regenerate and newly form cartilage cells through the MBST® concerning the principle of the nuclear magnetic resonance therapy was able to be observed. In doing so the hypothetical mode of action is however not yet verified on an experimental basis as contrary observations were made on the same test animal in the same laboratory (6, 7).

In contrast, countless clinical studies which were carried out directly on patients (8-12) highlight the effectiveness of the MBST® nuclear magnetic resonance therapy. Thus, a positive effect was able to be determined with an average of 75% of the patients (13), which was characterized by a partly significant reduction of the pain caused by osteoarthritis and an improvement of the joint function. There are only a few findings regarding the duration of the success of the therapy. At present, a positive effect was able to be proven up to a year after the treatment (14); however information concerning a longer period of time cannot be found in literature sources. Therefore the aim of this study is to give information about the long-term effectiveness of the MBST nuclear magnetic resonance therapy in terms of osteoarthritis and to serve as quality control and a possible indicator for the additional approach to the treatment of osteoarthritis. The data which form the basis of this study were collected by means of a questionnaire and contain information on the frequency and intensity of pain and on the everyday restrictions caused by osteoarthritis.

<sup>1</sup> MedTec Medizintechnik GmbH, Sportparkstr. 9, 35578 Wetzlar, Germany, <http://www.mbst-medical.com>

The duration of the pain, the type of pain and the degree of the alleviation of the pain are investigated under the aspect of various patient features such as age, gender and sport-related activities.

### Bases of the study

#### MBST® magnetic resonance procedures

MBST® nuclear magnetic resonance therapy is derived from the diagnostic Magnetic Resonance Imaging (MRI) and is based on the physical principle of magnetic resonance with which the water molecules of the body firstly take up energy via external magnetic fields and then release it again to the surrounding tissue. Different studies (2-4) point out that this results in an induction of individual signaling cascades due to the electromagnetic fields used with the MBST® on a bio-chemical level

and thus in an influence of bio-physical processes, whereby the cartilage growth is stimulated. The central element of the MBST® therapy device is a magnetic coil in which the joint is placed in the middle (Fig. 1).

Therapy parameters relevant to the treatment such as field strength, resonance frequency and treatment time are read into a separate control unit by means of pre-programmed chip cards. Three different fields are integrated in order to produce the magnetic resonance condition.

A static main magnet field serves the purpose of aligning the water molecules in the tissue.

Vertical to this, an oscillating electromagnetic field introduced in the form of radio impulses is produced which generates the magnetic resonance.

Finally a temporal sinusoidal varying sweep field parallel to the main magnet field ensures that the smallest, naturally existing, locally active magnet fields balance out in the tissue. The magnet field strength of the main magnet field ranges from 0.4 m T to 2.35 m T and is thus approximately 10,000 times weaker than the fields of an MRI. In order to produce the magnetic resonance, the radio impulse frequencies dependent on the main magnet field strengths are between 17 KHz and 100 KHz.

#### Bases for evaluation

The results of the present study are based on questionnaires on the condition of the pain and on the everyday restrictions experienced by 39 gonarthrosis patients with whom the treatment with the MBST® nuclear magnet resonance therapy dates back to 4 years at the time of the current questionnaire.

Table I: Distribution of various features of the patients involved in the study

		Number of patients	
		Distribution (number)	Percentage (%)
Gender	male	22	56,4
	female	17	43,6
Alter	< 60 years	18	46,2
	> 60 years	21	53,8
sport-related activity	active	25	64,1
	Not active	14	35,9
Time since therapy	<1 year	9	23,1
	1-2 years	9	23,1
	2-3 years	8	20,5
	3-4 years	13	33,3
Pain level before therapy (PPL / MPUS / RP) <sup>1)</sup>	low (0-2)	14/12/28	38/31/74
	medium (3-5)	14/17/10	38/45/26
	high (≥6)	09/09/00	24/24/00
Lequesne-Score before therapy	low (0-4)	12	31,6
	medium (5-7)	13	34,2
	high (≥8)	13	34,2

<sup>1)</sup> Peak pain level/medium level pain under strain/resting pain



Fig. 1: A MBST® therapy device, consisting of a magnetic coil and a separate control unit (from MedTec Medizintechnik GmbH, Wetzlar, Germany).

The patient data contains information on the condition of health directly before and after the therapy as well as 6 months after the therapy and at the respective point in time. The MBST® treatment was carried out in nine sessions of 60 minutes respectively and took place on subsequent working days. The questioning was carried out by means of an anonymized patient questionnaire concerning the self-assessment of the course of the illness which was represented by the frequency and intensity of the pain resulting from spontaneously occurring peak level pain, medium level pain under strain and resting pain as well as the Lequesne index for knee diseases (15). Whilst the information on the frequency and intensity of the pain are recorded directly via a numerical analogue scale of zero (no pain) to ten (continuous pain and/or the strongest level of pain imaginable), the Lequesne index is determined indirectly via a multiple choice questionnaire regarding restrictions on everyday activities such as climbing the stairs. Point values from zero (problem-free) to two (impossible) are allocated to the possible answers; a total of 24 points can be reached, whereby higher values indicate a worse ability to function with regard to the joint.

Subsequently, margin conditions such as the physical activity, age and gender are investigated for a differentiated analysis of the data collected.

### Patient distribution

The age span recorded stretches over a wide area of approximately 20 to 80 years, however younger patients under 50 years old are only marginally (8%) represented in accordance with the age-dependent distribution of a degenerative disease such as osteoarthritis. The types of sport-related activities carried out correspond to endurance activities which are 90% joint-friendly such as cycling or swimming. Merely 10% of the patients take part in sports which cause a strain on the joint such as soccer or tennis which do not support the osteoarthritis treatment. On the whole there is a very homogenous distribution of the patients, both in the area of these personal features and the area of the health condition before the start of the therapy and the time passed since the treatment (Table I).

## Results

### General overview

In all investigated areas, the intensity and frequency of the pain and the Lequesne index, a general overview of the study shows a shift of all levels to lower values and thus an improvement of the condition of health. The comparison of the distribution of the pain and Lequesne level before and after the therapy (Fig. II) shows a clear increase of the percentage of patients with no [0] to low [1] pain. Similar characteristics can be determined in terms of the frequency of the pain. The percentage of patients in the lower area of points [0-1] increases from 50-60% to 85% with resting pain, from 10% to 40-55% with medium level pain during movement and from 15% to 40% with spontaneously occurring peak level pain. At the same time the percentage of all patients with larger levels of pain decreases [ $>5$ ] to a maximum of 15%. This percentage was partly over 60% before the therapy. A shift to lower levels can also be observed with the Lequesne index. In this case the percentage of patients with a small to no handicap increases from approximately 30% to 45%.

Table II: Comparison of the percentages of patients with increases and decreases in terms of the pain level and the Lequesne index under specification of the respective average change in points:

	Pain intensity			Pain frequency			Lequesne Index
	PPL <sup>1)</sup>	MPUS <sup>2)</sup>	RP <sup>3)</sup>	PPL	MPUS	RP	
Increase	35% (1,5) <sup>4)</sup>	22% (1,5)	11% (1,5)	16% (2,2)	8% (2,3)	11% (1,5)	39% (2,1)
Decrease	54% (3,5)	68% (3,2)	62% (2,2)	68% (4,3)	76% (4,3)	49% (4,4)	61% (4,0)

1)Peak level pain, 2)medium level pain under strain, 3)(average increase and decrease) Resting pain, 4)percentage of patients

The assessment of the individual health development (Table II) shows that the pain and its' frequency in the treated knee joint increases with 50 to 70% of the patients during the course of the investigation period, depending on the type of the pain. At the same time, reductions of the pain values by up to 9 points are observed. Contrary to this, increases in pain are limited to low point values and correspond to the natural course of illness. The temporal course of the average pain values and the Lequesne index (Fig. 3) documents a significant improvement to the condition of health up to three years after the MBST® treatment, however with the restriction that there is a time-limited worsening period after six to twelve months. Furthermore, a slight increase of the pain and its frequency at the end of the test period of 4 years can be observed, whilst the tendency in terms of the Lequesne index continues to decrease.

The gender-specific assessment of the data results in a slight favoring of the female patients, who experience a stronger decrease in the pain intensity and the Lequesne index. In contrast, a higher reduction of the frequency of the pain can be seen with the male patients. Nevertheless, the value after the treatment is in the same range as the female comparison group, as this group already suffered less from pain before the therapy. Following this, an analysis of the physical activity shows an effectiveness of the therapy which is dependent on the type of pain. Thus, the physically active group shows a slightly higher reduction of the intensity and frequency of peak level pain, medium level pain and the Lequesne index.

Despite this, the corresponding values are above the values of the non-sports active comparison group, even after the therapy. This additionally shows a significantly higher decrease in terms of the resting pain, which is practically non-existent with the non-active group anymore. In summary, a more positive effect cannot be acknowledged through partaking in sports which support the therapy.

### Discussion

The results of the study have shown that even in the long term the MBST® is also able to have a positive influence on the restrictions with carrying out everyday activities assessed by the Lequesne index as well as on the intensity and frequency of the pain.

### Dependency of personal features

The investigation which took age, gender and physical activity into consideration, shows that the success of the therapy is substantially dependent on these factors (Table III). A comparison of the ages shows that the treatment is considerably more effective with older patients. Thus, these values in the middle illustrate a larger reduction in the intensity and frequency of the knee pain and the degree of restriction in terms of everyday activities decreases even more in relation to the older comparison group. If these point values were still above the values of the younger comparison group before the therapy, they sink in all areas to a lower level after the therapy.

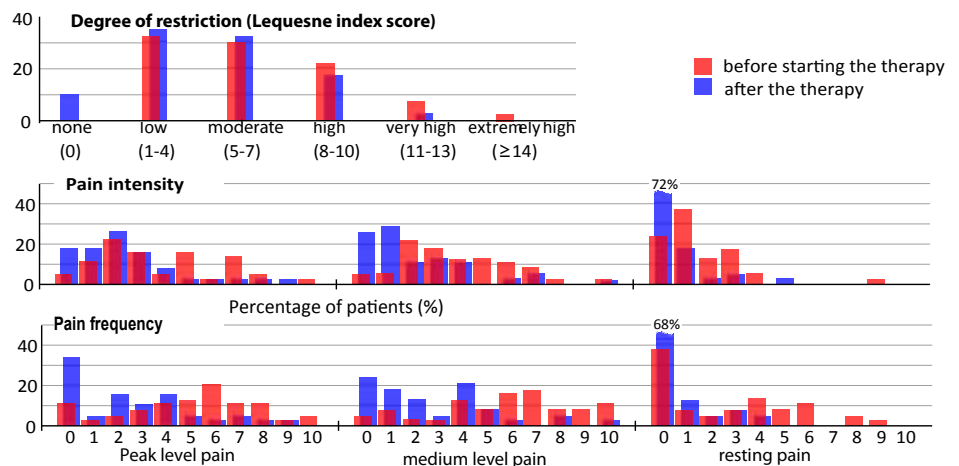


Fig. 2: Distribution of the pain and Lequesne level before and after the MBST® treatment.

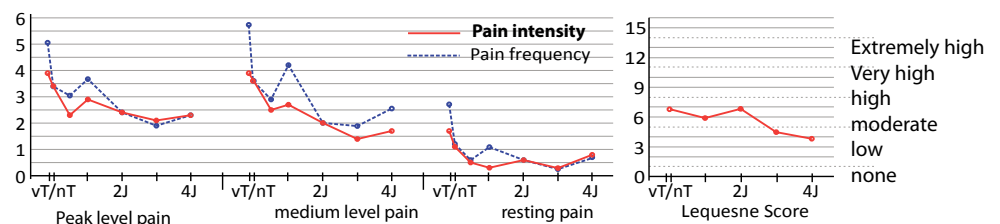


Fig. 3: Temporal development of the pain values and the Lequesne index after the MBST®.

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The analysis of the reduction of the pain intensity shows that the extent of the reduction is not fundamentally correlated to the corresponding value before the treatment but rather to additional factors such as gender, age and physical activity. In contrast, a clear relation between the frequency of the pain before the therapy and the degree of the pain reduction can be observed; a higher value before the treatment leads to a high level of pain frequency reduction. Patients with higher degrees of osteoarthritis and/or more activated forms benefit from this considerably more. The gender-specific comparison shows that the therapy has a significantly more positive effect on the female patients despite similar values at the start in relation to the pain intensity and the Lequesne index, so that presumably an increase in the bone density caused by the therapy, which tends to be low at least after the menopause and constantly decreases is more noticeable

and consequently subjectively leads to a higher reduction in relation to the pain. In relation to the age-related analysis the study shows that there is a considerably more significant decrease in the restrictions with regard to the older group of patients and significant reductions in regard to the intensity and frequency of the pain. Possible causes may be the older age and degree of rest which this group of patients has/undertakes which ensures that they are not exposed to the physical strains of a job and heavier strains in relation to everyday activities. Furthermore it is also worth considering that there may be an accompanying effect in this case on the osteoporosis which is mainly evident at this age.

Table III: Development of the pain level and the Lequesne index, taking into consideration age, gender and physical activity.

Age		Pain intensity			Pain frequency			Lequesne Index
		PPL <sup>1)</sup>	MPUS <sup>2)</sup>	RP <sup>3)</sup>	PPL	MS	MPUS	
< 60 y.	vT / nT <sup>4)</sup>	3,9 / 2,8	3,7 / 2,3	1,6 / 0,6	4,9 / 3,4	5,4 / 3,3	2,6 / 0,9	6,4 / 5,3
	Diff (%)	-28	-38	-63	-31	-39	-65	-17
> 60 y.	vT / nT	3,8 / 2,1	4,0 / 1,8	1,8 / 0,4	5,2 / 1,9	6,1 / 2,2	2,8 / 0,5	6,9 / 5,1
	Diff (%)	-45	-55	-78	-63	-64	-82	-26
Gender								
male	vT / nT	4,0 / 2,6	3,9 / 2,5	1,7 / 0,5	5,9 / 2,6	6,4 / 3,0	3,1 / 0,6	7,0 / 5,8
	Diff (%)	-35	-36	-71	-56	-53	-81	-17
female	vT / nT	3,7 / 2,2	3,8 / 1,5	1,6 / 0,5	4,1 / 2,4	4,9 / 2,3	2,2 / 0,8	6,2 / 4,4
	Diff (%)	-41	-61	-69	-41	-53	-64	-29
Physical activity								
active	vT / nT	4,1 / 2,6	4,1 / 2,3	1,8 / 0,7	5,6 / 2,6	6,1 / 2,7	2,6 / 0,9	7,1 / 5,6
	Diff (%)	-37	-44	-61	-54	-56	-65	-21
Not active	vT / nT	3,4 / 2,2	3,4 / 1,8	1,6 / 0,2	4,1 / 2,4	5,2 / 2,6	2,9 / 0,2	6,0 / 4,5
	Diff (%)	-35	-47	-88	-41	-50	-93	-23
1)Peak level pain, 2)medium level pain under strain, 3)resting pain, 4) before the therapy / after the therapy								

The data concerning sport-related activity show a slightly larger decrease in medium level and peak level pain in the sports-active group, whereby the level of pain still remains above the pain level of the non-active patients even after the treatment. Despite this, a significantly more positive effect on the resting pain is experienced by the non-active patients so that on the whole it tends to be largely more successful for this group of patients. Supporting of the therapy on the everyday restrictions and the pain behavior through physical activities thus cannot be identified. A possible cause of this could be that even carrying out tissue-friendly types of sports may lead to negative effects on the cartilage tissue as a result of carrying them out incorrectly or falsely estimating the individual exercise capacity. On the whole, the group specific analysis shows that respectively the group which generally has a lower level of physical strain illustrates a larger extent of success in terms of the therapy. A possible cause for this is over-exertion on the degenerated tissue structures through unusual or possibly too much strain during everyday activities as well as during sport-related activities. As the individual level of resilience towards strain on the cartilage tissue is based on diverse factors such as cartilage thickness, body weight and diet, a correct estimation of the capacities is not possible in most cases. Therefore there should be enough time for the body to regenerate and re-build the attacked structures even after a reduction in the ailments. Heavier levels of strain should also be avoided. In relation to sports, it is best to carry out sports which have a positive effect on the affected joints. Swimming and cycling without considerable resistance (e.g. slopes) are recommended for the knee joint. The latter in particular supports the cartilage metabolism through constant alternating pressure strain.

### Conclusion

The study has shown that the MBST® nuclear magnetic resonance therapy can be significantly successful in treating osteoarthritis and that the regeneration process is not completely finished even after years. However as the condition of health has worsened in individual cases, the treatment cannot guarantee improvement. The crucial basis for successful therapy with patients is nevertheless always clinical improvement of the condition. Alongside measurable improvements in relation to function, this also includes how the patient is feeling subjectively. The MBST® nuclear magnetic resonance therapy appears to significantly improve this jointly crucial clinical criterion. The patients are quite evidently better even for years after said therapy. Additional and likewise usually expensive procedures are thus often unnecessary. What can be seen is that in terms of older patients with whom the osteoarthritis is often advanced, there is a significant improvement in terms of the condition. A total endoprosthetic replacement of the joint can thus be delayed by years in many cases or it can even be prevented. Currently, there are no other conservative methods which are known to produce similar results.

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